

LIFE HISTORY AND BIOLOGICAL NOTES ON
CHLAENIUS IMPUNCTIFRONS SAY.
(COLEOPTERA, CARABIDÆ).*

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In the Proceedings of the Entomological Society of Washington I, 22, 1884, C. V. Riley says: "Perhaps one of the most interesting discoveries of the year 1884 is the mode of oviposition in some of our Carabidæ. From the terrestrial habits of most of our species one would expect that the eggs are deposited within the ground, and such may yet prove to be the case with many; but I have proved by actual breeding from eggs to the imago that it is not so with *Chlænius impunctifrons*, and have strong proof that *Chlænius æstivus*, *Scarites subterraneus* and the genera *Dicælus* and *Galerita* share with that species its singular mode of oviposition. The remarkable and unexpected fact, in insects so essentially terrestrial, is that the eggs are laid singly on the leaves of trees and shrubs and encased in a covering of mud or clay. I had often observed these little convex mud cells on the under side of leaves while collecting along the Mississippi in Missouri in years gone by, and was puzzled to make out their real nature. In May and June, 1883, while collecting on the Virginia side of the Potomac, I found these clay cells tolerably common and, fortunately, fresh, each containing a large soft white egg. That year I obtained larvæ, but only during the past year were any of these reared to the imago."

The above account is not accompanied by any figures or descriptions, and as far as I am aware, the life history of *Chlænius impunctifrons* has not been written hitherto.

On May 23, 1918, while collecting in the cat-tail marshes around Ithaca, New York, I observed a little ball of mud on the upper surface of a leaf of *Typha*. The mud ball occurred near the tip of the leaf, four to five feet above the surface of the ground. I took the leaf with the mud ball into the laboratory and upon breaking it open found a glistening white egg inside. Plate VI, Fig. 5. The egg was put into a tin salve box for rearing. The following day I found two more of the same kind of mud

* Contribution from the Department of Entomology, Cornell University.

cells, each on a *Typha* leaf near the tip. These two specimens also were brought to the laboratory and placed in the tin box with the other egg.

On May 28th the first egg had hatched. The young larva had opened one of the other mud balls and devoured the egg within. The third mud ball was then removed to another tin box. The first young larva died two days later, May 30th. That left only one egg of the lot. This egg hatched on the first of June, six days after it had been brought into the laboratory. The young larva was transferred to another clean tin salve box containing moist, sterilized sand.

Various kinds of food were offered to the young larva; larvæ and pupæ of *Lymnæcia phragmitella* Stainton, larvæ of *Nonagria oblonga* Grote, *Arsilonche albovenosa* Goeze, and *Arzama obliqua* Walk. Flies and fresh meat were also offered to the larva. At first the young larva fed somewhat on flies and on larvæ and pupæ of *L. phragmitella*, but it showed a decided preference for the little larvæ of *A. obliqua*.

During the second and third instar all other food was refused except larvæ of *A. obliqua*.

All the above mentioned Lepidoptera are inhabitants of *Typha*. *A. albovenosa* is an incidental surface feeder on the leaves; *L. phragmitella* lives in the heads of *Typha*, while *A. obliqua* and *N. oblonga* both begin their larval activities as leaf miners, later becoming solitary stem borers.

It is possible that the larvæ of *Chlænius impunctifrons* feed altogether on the larvæ of *A. obliqua*. The former hatch about the same time that the larvæ of the latter species leave the mines of the leaves of *Typha* to become stem borers. Thus while they are exposed they might easily fall prey to the Carabid larvæ.

On June 3, 11:00 A. M., the larva cast its first skin, the first instar having lasted three days. June 6, at noon, the larva molted again. The third instar larva had a voracious appetite and consumed many of the little *A. obliqua* larvæ. Five days later, June 11, the larva had tunneled into the moist sand and hollowed out a little cell. In this cell it was lying on its side as if ready to pupate. Having been disturbed the larva came to the surface of the sand and remained there, lying on its back. Whenever the box was opened it made efforts to turn over but was unable to do so. When turned over the larva crawled

about a little but soon fell over on its back again. In this condition the larva remained on top of the sand for sixteen days without taking any food. On June 27th the larva pupated. The pupa remained quietly on its back till July 4th, when the adult emerged. The adult was rather weak. The legs, especially the metathoracic legs, were not fully developed. The adult specimen was determined by Dr. J. C. Bradley.

TABLE OF INSTARS.

		LENGTH OF STAGE
Egg found.....	May 24.....	
Egg hatched.....	June 1.....	Egg stage 7 days plus?
First molt.....	June 3.....	First instar 3 days.
Second molt.....	June 6.....	Second instar 3 days.
Pupation.....	June 27.....	Third instar 21 days.
Emergence of adult.....	July 4.....	Pupal period 7 days.

DESCRIPTION OF STAGES.

MUD CELL.

(Plate VI, Fig. 5).

The little mud ball which encloses the egg is made of fine gray sand. It is placed singly on the upper surface of a *Typha* leaf six to eight inches from the tip. The mud ball is oblong oval, somewhat depressed. It measures 3.43 mm. in length, 2.28 mm. in width, and 1.75 mm. in thickness.

EGG.

(Plate VI, Fig. 1).

In the center of the mud cell occurs the egg. It is oblong oval, of a glistening white color, with rather large faint reticulations. It measures 2.28 mm. in length and 1 mm. in its greatest diameter.

FIRST INSTAR LARVA.

(Plate VI, Fig. 3).

Color. General color of larva dark brownish black, except in the less chitinized places which are grayish white. Head yellowish brown with a dark brown area in front between the epicraneal sutures. Antennæ and maxillary palpi dark brown, with a narrow yellow-brown ring at the joints.

Form. The body is elongate, tapering to both ends, but more posteriorly. The ninth abdominal segment bears two processes which equal the combined length of the pro- and mesothorax. The anal tube projects postero-ventrad from the ninth abdominal segment.

Head. Head, excluding mouthparts and appendages, wider than long, narrowed behind the eyes. Dorsal surface slightly convex, with two short oblique grooves terminating at the lateral margin. Ventral surface more convex. Edge of labrum roughly toothed, with one larger tooth on each outer angle of the anterior margin. Surface of head smooth

with few hairs. Ocelli six, on a raised portion back of the antennæ. Antennæ four-jointed, the first and fourth joint about equally long; the second joint two-thirds the length of the first; the third joint slightly longer than first, with a crook above the middle. Two or three bristles originate from this outward crook or elbow, and one from the inner side. Fourth, or apical joint, with four bristles at the tip.

Mandibles long curved, with a strong tooth below the middle, directed inward and slightly downward. A small bunch of hairs near the inner base of mandibles.

Maxillæ with a long stout basal joint, bearing numerous hairs, especially on the inner and upper surface. Outer palpus four-jointed; first joint as wide as long, second joint somewhat more slender and at least twice as long; third joint slender and a little shorter than second; fourth joint as long as first, but very slender. Inner palpus two-jointed, the basal joint stouter and a little longer than second. Just inside the inner palpus is another small joint tipped with a bristle.

Mentum about as wide as long. Anterior margin produced to a point bearing two hairs. Palpus with basal joint little longer than broad; second joint little longer than first and tapering greatly.

Prothorax narrowing anteriorly, a third wider than long. Surface finely punctate.

Meso- and Metathorax each twice as wide as long.

Abdomen of nine true segments, gradually tapering posteriorly. The ninth segment bears the anal tube and the two posterior processes. These processes each bear five long stout hairs, three about equidistant along the process and two at the tip.

Legs long with stout hairs and two claws at the tip.

Measurements of Cast Skin. Length from tip of mandibles to tip of caudal processes, 7.43 mm.; greatest width across thorax, 1.26 mm.

SECOND AND THIRD INSTARS.

The second and third instar larvæ do not differ greatly in structure from the first except in size and proportions. The first instar is more spindle shaped. The body of the second and third instar is more flattened.

SECOND INSTAR LARVA.

(Plate VI, Fig. 7).

The second instar larva differs from the first in the following points.

Antennæ. First and third joint of equal length. Second and fourth joint subequal, each a little shorter than first and third joint.

Palpi of mentum with basal joint twice as long as broad; second joint as long as first.

Prothorax about twice as wide as long.

Meso- and Metathorax each more than twice as wide as long.

Caudal processes with four long hairs; one about half way back, another three-quarters back, and two at the tip.

Measurements of Cast Skin. Length from tip of mandibles to tip of caudal processes, 10.28 mm.; greatest width across thorax, 2.25 mm.

THIRD INSTAR LARVA.

(Plate VI, Fig. 4).

Antennæ. First, second and third joints of equal lengths. Fourth joint about two-thirds the length of the other segments.

Prothorax less than twice as wide as long, i. e., the width equals one and three-quarters the length.

Caudal processes as in the second instar.

Measurements of Cast Skin. Length from tip of mandibles to tip of caudal processes, 14.57 mm.; greatest width across throax, 3.43 mm.

PUPA.

(Plate VI, Fig. 2).

The pupa is of a creamy white color. The eyes are the first to show a mottled brown color. The mandibles also become chitinized early.

Ventral view. Head bent under so as to show a small portion of the prothorax. Labrum and clypeus together a third longer than broad, emarginate in front. Mandibles long with a notch and tooth at the apex. Maxillary and labial palpi plainly visible. Front of head with four setæ arranged as shown in figure. Antennæ eleven jointed, the tips almost reaching the tips of the metathoracic wings. Prothoracic legs extending to a point half way between the tips of the maxillary palpi and the tips of the antennæ. Mesothoracic legs underneath the antennæ, extending slightly beyond the tips of the antennæ. Metathoracic legs visible only at the tips where they project from beneath the metathoracic wings. Elytra show the longitudinal striæ plainly. The elytra extend about two-thirds the length of the metathoracic wings. Wings with a hump on the lateral margin. They extend back to a point one-third across the fourth abdominal segment. Abdomen with segments two to nine visible. Segment two with a small hair-tipped tubercle on each lateral margin. Segments three, four and five each with lateral processes as shown in the figure. Segments seven and eight smooth. Segment nine with two short posterior tubercles.

Dorsal view. Dorsally the pupa presents a hairy appearance. Long hairs occur on all but the last three abdominal segments. On the thorax the hairs are shorter and occur more scatteringly. On segments one to six, of the abdomen, the hairs are long and are arranged in two groups on each segment; one group on each side of the median line. The hairs are arranged in two more or less distinct rows, thirteen hairs in each lateral group, or twenty-six long hairs on each segment.

Measurements of the living pupa. Length, 10.28 mm.; greatest width of abdomen not including the lateral processes, 4.57 mm.

ADULT.

(Plate VI, Fig. 6).

The adult which emerged from the pupa in the laboratory measured 13.7 mm. in length and 4.7 mm. in its greatest width. The original description of the adult is found in the Transactions of the American Philosophic Society II, 64, 1823.

EXPLANATION OF PLATE VI.

Chlaenius impunctifrons Say.

- Fig. 1. Egg, length 2.28 mm. .
Fig. 2. Pupa, ventral view, length 10.28 mm.
Fig. 3. Larva, first instar, length 7.43 mm.
Fig. 4. Larva, third instar, length 14.57 mm.
Fig. 5. Mud cell on leaf. Opened to expose egg inside.
Fig. 6. Adult beetle, length 13.7 mm.
Fig. 7. Larva, second instar, length 10.28 mm.

Figures 2, 3, 4, 6 and 7 all drawn to the same scale.

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